

The creation and management of innovation in healthcare

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VALORISATION

Valorisation

Personalised medicine is no longer an abstract healthcare approach. However, to become truly individualized, a final step is needed. The advances in genetics and healthcare over the last two decades have changed the landscape of healthcare and have led to a new understanding of diseases. In the coming years/decade further advances will enable the discovery and developments of truly personalised medicines and treatments. The analysis performed in this dissertation identified several hurdles and barriers that are currently slowing down the innovation process and the implementation and uptake of PM among European healthcare systems. Those insights will contribute to further strengthen the uptake of PM by addressing those challenges.

In the following paragraphs it is described what impact the research performed in this dissertation is likely to have for different stakeholders. In general, the results of this dissertation might be of interest for several stakeholders including policy makers, citizens, healthcare professionals and innovators. However, the relevance of the findings is not limited to the beforehand mentioned stakeholders, the result might also be of interest for other stakeholders.

Impact for innovators

The first target groups are the innovators. The innXchange innovation wheel, described in Chapter 2, is designed to help innovators to address the identified barriers as well as allow them to successfully create and manage innovations such as PM. The innXchange innovation wheel is not only providing guidance for innovators, it also emphasizes the inclusion of all stakeholders involved in the innovation process. The underlying concept of the wheel, systematic early dialogue, can be a crucial enabler for innovation and PM. The innXchange wheel and the guidelines are in accordance with the PerMed SRIA and are complementing it. In addition, applying the innXchange innovation wheel in this dissertation allowed to provide new insights with regard to barriers that are currently slowing down the uptake and implementation of PM. This new knowledge can help the PerMed consortium to further strengthen the implementation of PM in Europe.

The findings of the research performed in Chapter 2 and 3 have the potential to help innovators to improve their innovation capacities by addressing common challenges and

hurdles in the innovation process from the early beginning. The importance of systematic early dialogue has also been recognized by International Consortium for Personalised Medicine (PM). The consortium can play a crucial role in further validating the innXchange innovation wheel and to support its implementation and dissemination among key stakeholders.

In addition, the innovation wheel has been presented and discussed during two high-level workshops in Pretoria, South Africa in September 2017 and in Brussels, Belgium in October 2017. Invited participants of the workshops were high-level experts from the pharmaceutical industry, governmental institutions such as the representatives of the Ministry of Health of South Africa, research institutions such as the Netherlands Organisation for Health Research and Development (ZonMw) and the German Forschungszentrum Jülich, health technology assessment experts and private entrepreneurs. The framework was well recognized by the different stakeholders and more expert studies are now needed to further validate the wheel.

Impact for policy makers

The second target group are policy makers. The main findings showed that the innovation-ecosystem is of prime importance for the innovation process. Relying in the findings presented in this dissertation may improve the innovation process, since policy makers will understand the changing landscape of innovation better, which will allow them to modify their action to ensure that they are fit-for-purpose. As described in Chapter 2 and 3, innovation is no longer associated with R&D spending's. In addition, supporting the involvement and inclusion of all parts of society could be the key to improve the innovation process and to enable further developments in PM. Top-down approaches will be no longer applicable. New innovation approaches such as frugal innovation are currently challenging traditional approaches and have the potential to address many challenges that we are currently facing. If policy makers do not recognize those changes, Europe will fall further behind.

Approaches such as 'citizens science' and 'innovation / health literacy', which are described in Chapter 4,5 and 6, have to potential to strengthen the innovation capacities of Europe and the Member States. Citizens (the third target group) need to become actively involved in the

innovation process as well as in their treatment decision-making process. Health data cooperatives, described in more detail in Chapter 4,5,6 and 8, can be a crucial enabler for more involvement of citizens in science. However, it is important to mention that it is not exclusively the responsibility of policy makers to enable the involvement of citizens, it will also be the responsibility of the citizens themselves to become more active in the innovation process and as well as in the healthcare process.

In addition, policy makers will need to adapt regulation faster in order to ensure that new technologies are appropriately addressed. As highlighted, regulations and legislations need to support innovation and not hinder it. The results of the thesis highlight several regulations and legislations which are currently slowing down the innovation process and the uptake of PM. Policy makers can profit from the performed analyses. Throughout the dissertation disruptive solutions are presented will allow policy makers to address the current challenges appropriately. Disruptive solutions such as HDC and N=1 trials will ensure that our actions are fit-for-purpose to make Europe a global innovator and to further strengthen PM.

Impact for healthcare professionals

Furthermore, healthcare professionals, the fourth target group, can also benefit from the new insights. It will be of great importance that they understand the changing landscape of innovation and the potentials new technologies have. Therefore, healthcare professionals need to be more open for new technologies and medical approaches to provide patients with the best possible treatment. Especially, older generations of healthcare professionals are often reluctant to change and innovation and prefer traditional ways of working. The results dissertation highlight, that the traditional understanding of diseases is no longer working and in order to provide patients with the best treatment, they have to adapt their practice. The presented findings might help to introduce new approaches to healthcare professionals and to increase awareness of new technologies and healthcare approaches such as PM. Furthermore, healthcare professionals will have to include the patient as active participant in the treatment process instead of as passive recipient to further strengthen the role of PM.

I am aware that the research I performed is very explorative and that more research is needed to further validate the findings. However, key barriers that are currently slowing down the

innovation process and the uptake and implementation of PM have been highlighted and several disruptive solutions such as systematic early dialogue, health data cooperatives, N=1 trials and virtual twins are presented and which could help stakeholders to address the current challenges. Addressing the highlighted challenges, first on a small scale i.e. on local or regional level, can lead to bigger changes on national and even international level. The time is right for innovations in general and personalised medicine however we have to make our actions fit-for-purpose to achieve our objectives in the future and to make Europe a global innovator and to make Europe a pioneer in PM.

As it is with all scientific work, it can never cover the whole complexity of a topic in a limited number of pages. However, I believe that the findings of my research performed as part of this dissertation are innovative and contribute to the ongoing scholarly discussions as well as highlight / introduce new, until now rarely discussed topics, which need more attention in the next years to further improve the innovation capacities and the uptake of PM.